Mechanics 1 formulae:

Models

model	assumption
• particle (dimensions negligable)	• mass concentrated at point (weight acts at a single point) • resistive forces are negligable
• rod (all dimensions but one are negligable)	• mass concentrated along line • no thickness • rigid
• lamina (obj with area but negligable width)	• mass distributed across flat surface
• uniform body (mass distributed evenly)	• mass concentrated at geometric centre of body — centre of mass
• light object (small mass)	• treated as massless • tension same at both ends of light string
• inextensible string (does not stretch under load)	• constant acceleration in system
• smooth surface	• no friction
• rough surface	• experience resistive force (friction)
• wire (rigid)	• treated as one dimension
• smooth light pully	• pully is massless • tension is same on either side of pully
Bead (particle with hole in it)	• moves freely across string • if smooth, tension same
Peg (support)	• dimensionless & fixed • either smooth or rough
air resistance	• negligable
Gravity	• assumes same & act down

(Rasha's notes 2023
Best of luck!
You've got it!!! Believe)

- opposite of tension (breaking) is thrust (force of compression)
- buoyancy → upward force responsible for floating

constant acceleration

- average speed = $\frac{\text{total distance}}{\text{time}}$
- area in acceleration-time graph is $\Delta v = v - u$
- $a = \frac{v-u}{t}$, $s = \frac{(v+u)}{2} \cdot t$
- $v^2 = u^2 + 2as$, $s = ut + \frac{1}{2}at^2$, $s = vt - \frac{1}{2}at^2$

} suvat

→ accelerate up $9.8 m/s^2$
down $9.8 m/s^2$

- time between projection & hitting ground → time of flight
initials = speed of projection =

vectors

$r = r_0 + v(t)$ — displacement

r_0: position vector (starting)

r: position vector

dynamics of particle moving in straight line

- newton's first law of motion → obj will stay at rest (if at rest) & obj moving with constant velocity will continue doing so unless & until an unbalanced force acts on the object

- object accelerate in same direction of F_{net}
- newton's second law of motion → $F = ma$
- system can be treated as whole if they are moving in same straight line
- newton's third law of motion → for every action is an equal & opposite reaction
- in pully its not one system as not straight line motion

Forces & friction

(Friction has a max/limiting value
(when obj is on point of moving → limiting eq

- $F_{max} = \mu R$ — normal rxn
  (coefficient of friction

Momentum & impulse

$I = mv - mu$ → $a = \frac{v-u}{t}$

(N.s

$F = m\left(\frac{v-u}{t}\right)$

$Ft = mv - muv$

$Ft = I$ — newton's third law of motion imp

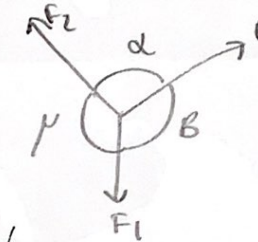
- principle of conservation of momentum:

$m_1u_1 + m_2u_2 = m_1v_1 + m_2v_2$

Statics of a particle

- If $F_{net} = 0$

(if you have 3 forces in eq they form closed triangle



$\frac{F_2}{\sin\beta} = \frac{F_1}{\sin\alpha} = \frac{F_3}{\sin\mu}$

(lami's theorem

- $F \leq \mu R$

* body is at static eq if → $a = 0$
$F_{net} = 0$
total/resultant moment $= 0$

Moment

(turning effect of force (N.m)

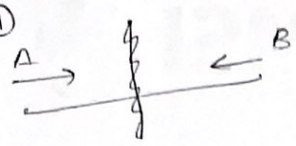
all bodies rigid

- $P = |F| \times d$

- eq → Resultant moment $= 0$

- reaction force always there between pivot & surface
- more downward force → more R
- at point of tilting → no reaction forces (tension $= 0$ / $R = 0$)

extra:

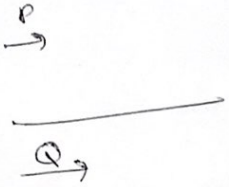
① 

$s_B + s_A = d$

②

$s_Q - s_P = d$

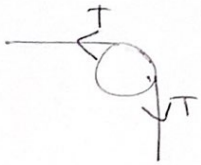
$s_P - s_Q = d$

③ 

$s_P = s_Q$

(at point of collision & outtaking

- for smooth surfaces, $a = g\sin\theta$ ∴ more inclided → more a
- same string → same tension
- $\tan\alpha > \mu$ → motion
- $\tan\alpha = \mu$ → limitin eq
- $\tan\alpha < \mu$ → eq

- 

→ $R = 2F\cos\frac{\alpha}{2}$

two particle connected with taut string will move at varying v until string becomes taut they then move at ~~constant~~ same velocity (commone)